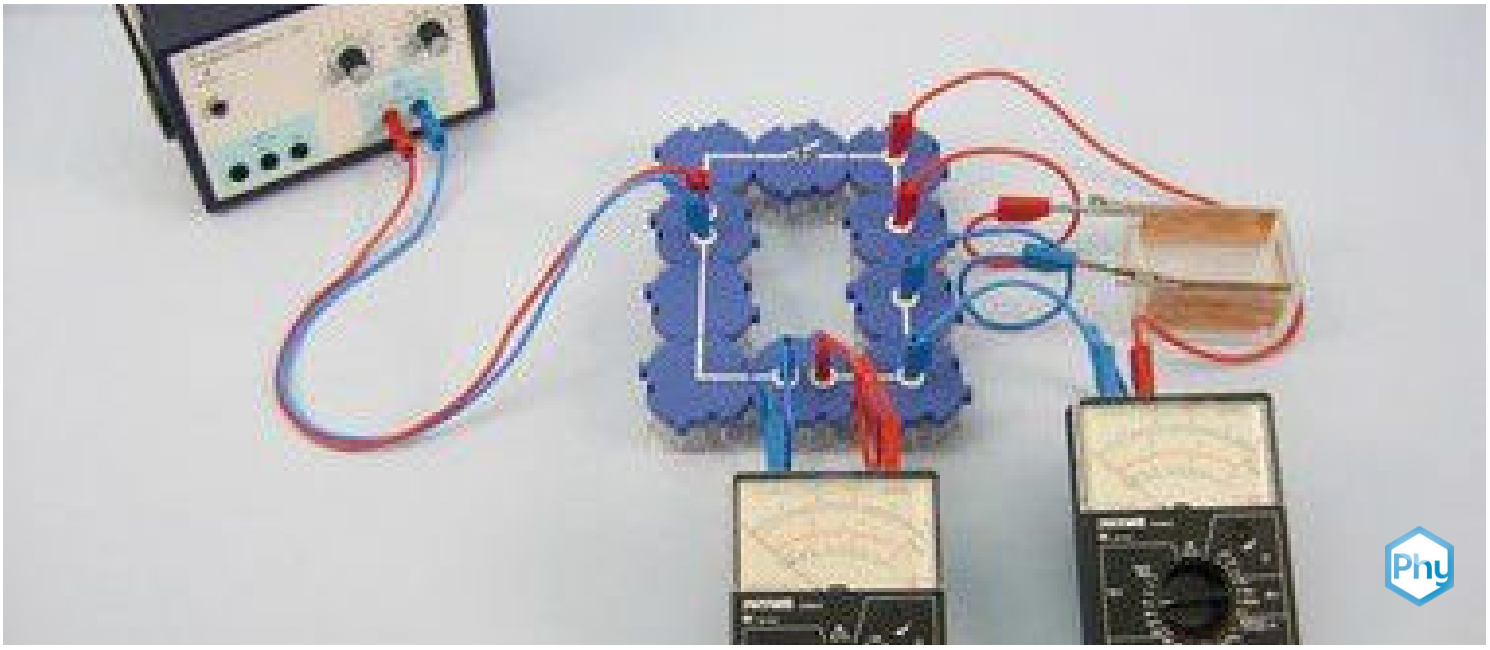
Controlling with a relay



The aim of this experiment is to teach the students how the control of electric circuits works in principle with the help of electromagnetic relays.

Physics > Electricity & Magnetism > Electromagnetism & Induction

Difficulty level	Group size	Preparation time	Execution time
medium	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/631458683e3d60000318b590

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Teacher information

Application

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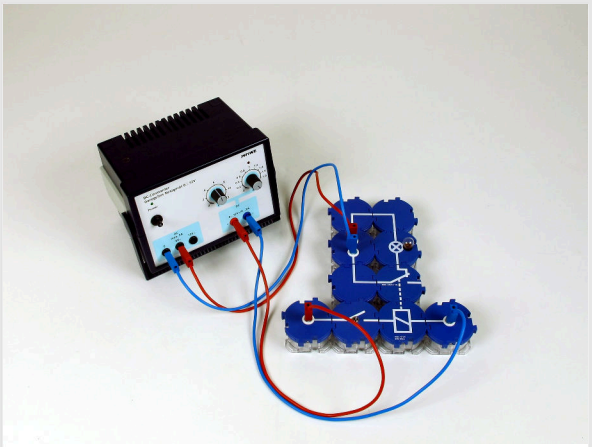

Experimental setup

Relays of various types are frequently used in switching technology, e.g. to open or close electrical circuits that are far away or difficult to access.

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Other teacher information (1/2)

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Prior knowledge

The students should have gained first experimental experience in using the power supply unit.

Principle

A mechanical relay usually works on the principle of the electromagnet. A current in the excitation coil generates a magnetic flux through the ferromagnetic core and a movable armature, which is also ferromagnetic. Force is applied to the armature at an air gap, causing it to switch one or more contacts. The armature is returned to its original position by spring force as soon as the coil is no longer energised.

Other teacher information (2/2)

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Learning objective

The aim of this experiment is to teach the students how the principle of controlling electric circuits with the help of electromagnetic relays works.

Task

Show that you can use an electromagnetic relay to open, close and switch circuits (working circuits).

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Safety instructions

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- The general instructions for safe experimentation in science lessons apply to this experiment.

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Student information

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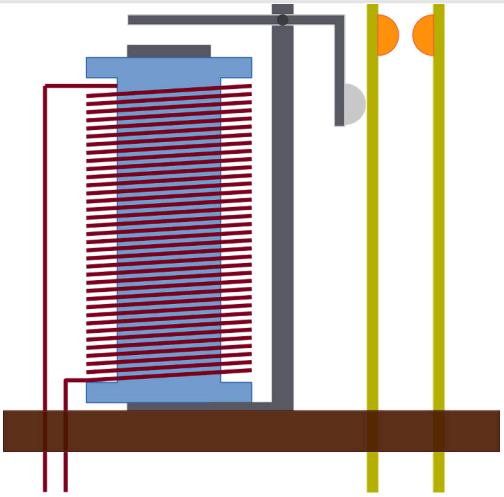
Motivation

Relays of various types are frequently used in switching technology, e.g. to open or close electrical circuits that are far away or difficult to access.

Therefore, a thorough understanding of how they work is of great importance.



one relay

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Equipment

Position	Material	Item No.	Quantity
1	Angled connector module, SB	05601-02	4
2	T-shaped connector module, SB	05601-03	1
3	Interrupted connector module with sockets, SB	05601-04	1
4	Junction module, SB	05601-10	2
5	On-off switch module, SB	05602-01	1
6	Socket module for incandescent lamp E10, SB	05604-00	2
7	Relais module 6 V, SB	05674-00	1
8	Connecting cord, 32 A, 500 mm, red	07361-01	2
9	Connecting cord, 32 A, 500 mm, blue	07361-04	2
10	Filament lamps 12V/0.1A, E10, 10 pieces	07505-03	1
11	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Set-up and Procedure (1/6)

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- Set up the experiment as shown in Fig. 1 and Fig. 2 with bulb L1 in the working circuit. The switch should be switched off. Set a DC voltage of 6 V for the control circuit and connect the working circuit to the AC voltage of 12 V~.
- Consider the available relay before you start the experiment.

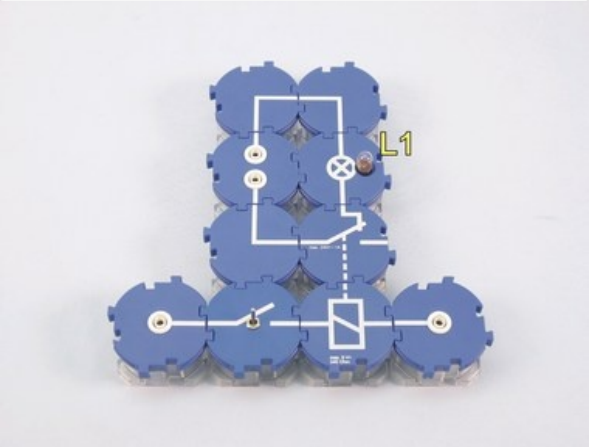

Fig. 1

Set-up and Procedure (1/6)

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- Set up the experiment as shown in Fig. 1 and Fig. 2 with bulb L1 in the working circuit. The switch should be switched off. Set a DC voltage of 6 V for the control circuit and connect the working circuit to the AC voltage of 12 V~.
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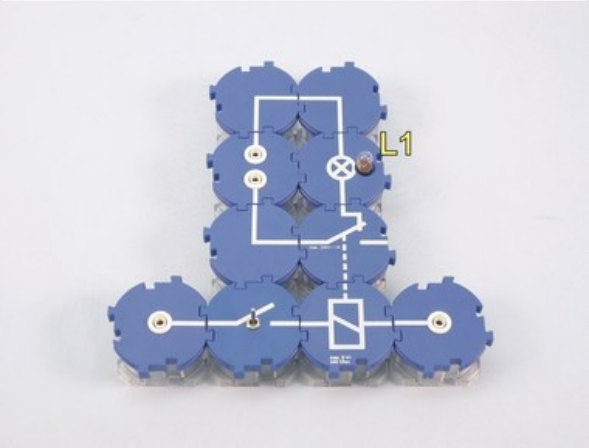

Fig. 1

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Set-up and Procedure (2/6)

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- Two contacts of one relay module are connected to the coil of the relay (R and R'). The three contacts in the other relay module belong to the switch of the relay. If the circuit containging the coil of the magnet **(control circuit)** is not closed, then the conductive connections are made as shown on the relay box.
- A connection that is closed when the control circuit is open is called **Break contact**. The relay acts as a normally closed contact of a **Working circuit**.

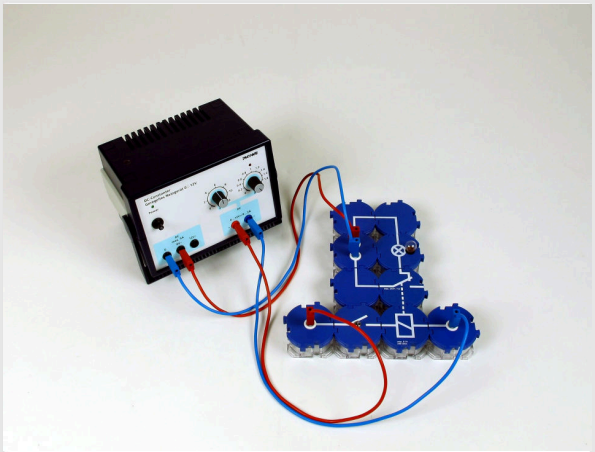

Fig. 2

Set-up and Procedure (3/6)

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- A connection that is open when the control circuit is open is called **Normally open contact**. The relay acts as **N/O contact** of a working circuit.
- Complete Table 1 in the report using Fig. 3.
- Switch on the power supply unit and observe bulb L1.
- Close and open the control circuit several times with the off switch. Observe the bulb L1 and note your observations in the report under "Result - Observations 1".

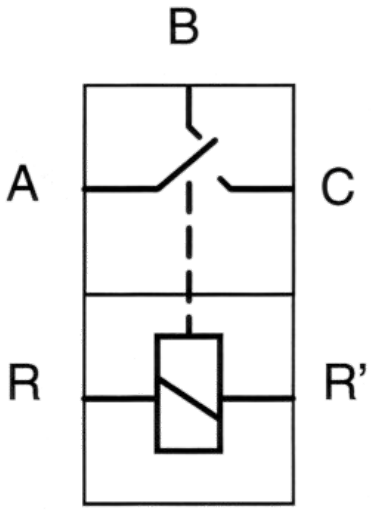

Fig. 3

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Set-up and Procedure (4/6)

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- Break the working circuit 1 by removing bulb L1 and set up the working circuit 2 with bulb L2 (fig. 4 and fig. 5).
- Close and open the control circuit several times with the off switch. Observe the bulb L2 and note your observations in the report under "Result - Observations 2".

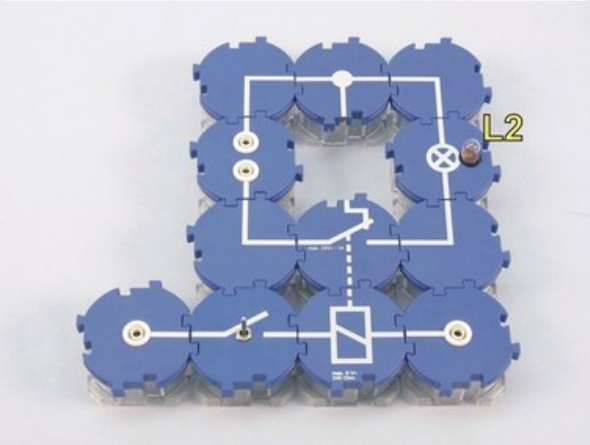

Fig. 4

Set-up and Procedure (5/6)

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- Close the working circuit 1 again with the bulb (Fig. 6 and Fig. 7). Close and open the control circuit several times with the off switch. Observe both bulbs and note your observations in the report under "Result - Observations 3".
- Switch off the power supply unit.

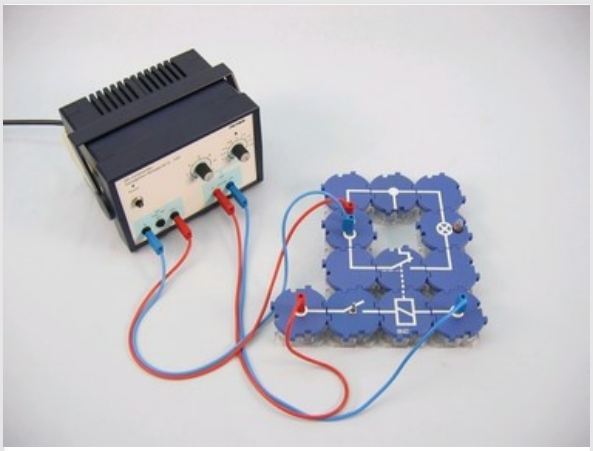

Fig. 5

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Set-up and Procedure (6/6)

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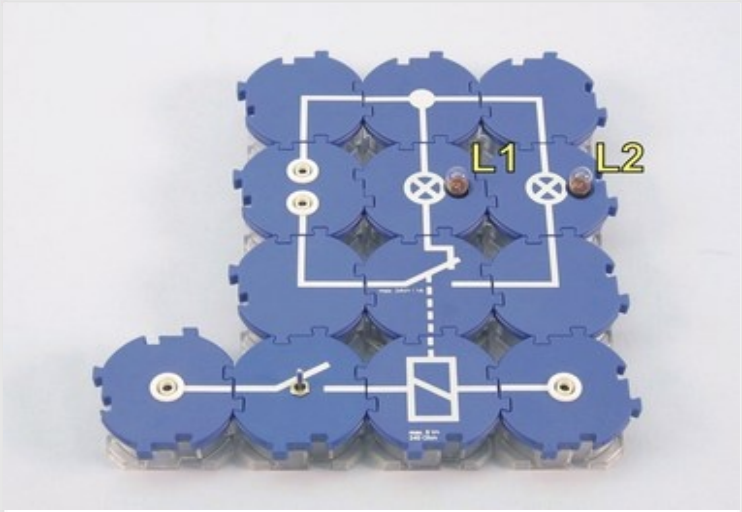

Fig. 6

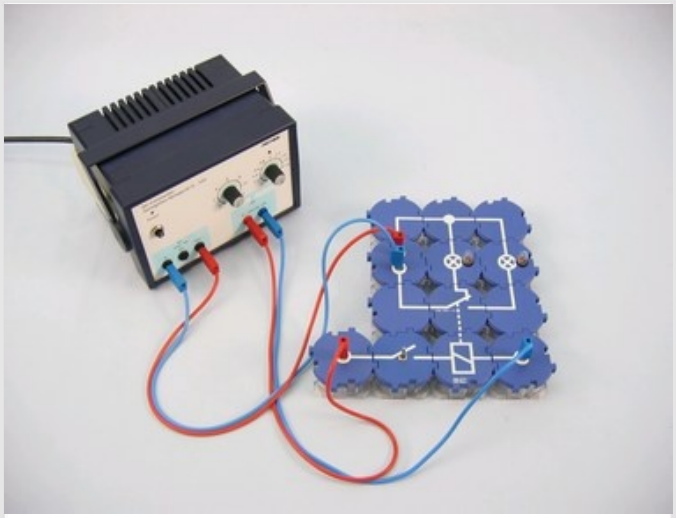

Fig. 7

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Report

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Observation (1/2)

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Circuit	Connection exists	Connection does not exist
closed		
open		

Write down your observations

Observation (2/2)

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Write down your observations

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Task

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What can you do with a relay?

- [ ] Switching high electrical power with low power.
- [ ] Noiseless shifting.
- [ ] Simultaneous switching of several load circuits with only one control circuit.

Check

Advantages of electrical relays.

- [ ] Low contact transition resistance.
- [ ] High switch-on power.
- [ ] Low response and drop-out time.

Check

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